## REMARKS

Applicant requests the Examiner to **withdraw** the objection to the disclosure, because the drawing reference numerals 55 and 90 are described in the specification at page 8, line 2 and page 7, line 4, respectively.

Applicant requests the Examiner to **withdraw** the objection to claims 1-17 in view of the above corrective amendments to claims 1 and 10.

Applicant also respectfully requests the Examiner to reconsider and **withdraw** the rejection of claims 12-15 and 17 under 35 U.S.C. § 112, second paragraph, in view of the above corrective amendments to claims 10, 12, 16 and 17.

Applicant also respectfully requests the Examiner to reconsider and **withdraw** the provisional obviousness-type double-patenting rejection of claims 1, 6-11, 14 and 15, in view of the enclosed Terminal Disclaimer which, *inter alia*, states that the term of any patent granted on the present application will not exceed the term of any patent granted on the commonly owned co-pending application 10/733,643, and that the two patents shall remain under common ownership.

Applicant respectfully **traverses** the rejection of claims 1-17 under 35 U.S.C. § 103(a) as being unpatentable (obvious) over Shiota '853 in view of either Nakatani '735 or JP '361. (Applicant notes that Shiota '853 is the counterpart of HEI-8-233851 cited and distinguished on page 2 of Applicant's specification.

In the acceleration sensor of the present invention, an adhesive paste, mixed with hard plastic balls having a diameter larger than the length of a gap between an upper surface of a mass

portion and a lower surface of an upper regulation plate, is filled into a plurality of recesses provided on an upper surface of a thick frame. Protrusions of the adhesive paste from openings of the recesses define the gap-length. Since the diameter of the hard plastic balls is larger than the gap-length, the balls are held in the recesses so that the adhesive paste is confined at the recesses between a bottom surface of each of the recesses and the lower surface of the upper regulation plate, that is, in the recesses, and in regions above the recesses and under the lower surface of the upper regulation plate. The **adhesion area** of the paste sticking to the balls is restricted to the opening area of the recesses.

Shiota '853 discloses nothing more than the subject matter already described as prior art in Applicant's specification, especially at page 2 thereof. Furthermore, as described therein, this prior art suffers from the problem of a **variable adhesion area** which causes a **variation in the sensitivity** of the acceleration sensor chip.

Applicant's invention solves this problem by providing, *inter alia*,

> a plurality of recesses on an upper surface of the thick frame, each of the recesses having a bottom surface under the upper surface of the thick frame, [and] an adhesive paste disposed in the plurality of recesses [so that the] upper regulation plate [is] fixed on the upper surface of the thick frame [by the] adhesive paste disposed in the plurality of the recesses,

as clearly recited in independent claims 1 and 10.

Thus, although Shiota '853 discloses the broad concept of an adhesive mixed with hard plastic balls, Shiota '853 does not disclose, or even suggest, Applicant's "thick frame" having "a plurality of recesses" on its "upper surface", and in which recesses is disposed "an adhesive

paste", as recited at least in the last seven lines of claims 1 and 10. Furthermore, Shiota does not teach or even suggest an "adhesion area" that is limited to a certain specific region on the frame.

The Examiner admits that Shiota '853 does not disclose Applicant's primary novel feature of "a plurality of recesses on the upper surface of the thick frame", and attempts to overcome this deficiency by relying on the disclosure of Nakatani '735 or JP '361.

However, Nakatani's parts 34a-34d and 44a-44d are not "recesses" (as defined in Applicant's claims) but, rather, are "through holes" with no bottom surface, thereby being **incapable** of holding "an adhesive paste disposed therein" which **fixes** (bonds) the "upper regulation plate" to "the upper surface of the thick frame" to define a "gap" between the "upper regulation plate" and the "mass portion".

Furthermore, and as described in Nakatani '735 at column 7, lines 41-43,

> ...the grooves 34a-34d and 44a-44d at the four corners are filled with **electroconductive** paste to form **output terminals** of acceleration sensor.

Thus, this "electroconductive paste" in Nakatani is not an "adhesive paste" as claimed by Applicant, and, conversely, Applicant's claimed "adhesive paste" is **not** an electroconductive paste.

As for JP '361, it discloses grooves 31, 32 around adhesion areas for preventing adhesive from flowing out of the adhesion areas; however, the adhesive is **not** mixed with balls trapped in the recesses to confine the adhesion areas, as claimed in Applicant's claims 1 and 10. (An English translation of the text of JP '361 is enclosed for the Examiner's convenience.)

In light of the above-noted deficiencies in the disclosures of the primary reference, Shiota, and the secondary references, Nakatani and JP '361, Applicant respectfully submits that the Examiner has not made out a *prima facie* case of obviousness of the subject matter of any one of claims 1-17, because this combination of references fails to teach all of the elements recited in at least the independent claims 1 and 10.

Applicant respectfully submits that the Examiner has engaged in the prohibited use of hindsight reconstruction of the references based on the Examiner's knowledge of Applicant's own disclosure. For example, the Examiner offers only the following **conclusory** statement in support of the rejection under 35 U.S.C. § 103(a):

> It would have been obvious to a person of ordinary skill in the art at the time of invention to have readily recognized the advantages and desirability of employing the plurality of recesses on the surface of the thick frame as suggested by the references, Nakatani et al. and Takayama [JP '361], to the apparatus of Shiota to provide protection to the mass and the elastic arms when an external force/pressure is applied such that the thick frame will absorb the force/pressure and that the adhesive will not spread outside of the recesses to the mass and the elastic arms.

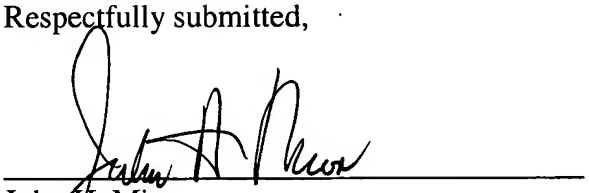
There is absolutely no suggestion to combine the references as proposed by the Examiner, and, furthermore, because of the above-noted deficiencies in the individual references, it is clear that even if, for some reason, the references were combined, there would not be produced the subject matter of any of claims 1-17 or subject matter which would have rendered claims 1-17 obvious.

Thus, Applicant respectfully requests the Examiner to reconsider and withdraw all objections and rejections, and to find the application to be in condition for allowance with all of

claims 1-19 (claims 18 and 19 have been added explicitly to recite that which is implicit in their respective parent claims 1 and 10; however, if for any reason the Examiner feels that the application is not now in condition for allowance, she is respectfully requested to **call the undersigned attorney** to discuss any unresolved issues and to expedite the disposition of the application.

Applicant hereby petitions for any extension of time which may be required to maintain the pendency of this application, and any required fee for such extension is to be charged to Deposit Account No. 19-4880. The Commissioner is also authorized to charge any additional fees under 37 C.F.R. § 1.16 and/or § 1.17 necessary to keep this application pending in the Patent and Trademark Office or credit any overpayment to said Deposit Account No. 19-4880.

Respectfully submitted,



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Translation of Japan Patent Document 7-128361

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Exr: Helen KWOK

Translation of Japan Patent Document 7-128361

[Claim]

[Claim 1] In an acceleration sensor comprising a mass part formed in one body through hinge parts in a rectangular frame part and first and second stopper boards fixed with adhesive to both sides of the frame part to prevent the mass part from excessively replacing,

the acceleration sensor characterized in that first and second grooves are formed on inner surfaces of the first and the second stopper boards, respectively, the grooves being adjacent the hinge parts and extending outside of the hinge parts and along inner peripheries of the frame parts.

[Detailed Description of Invention]

[0001]

[Industrial Field] The invention relates to an acceleration sensor comprising a mass part formed in one body through hinge parts in a rectangular frame part and first and second stopper boards adhering to both sides of the frame part to prevent an excessive replacement of the mass part.

[0002]

[Prior Technology] FIG. 2 shows a conventional acceleration sensor. A mass part 13 is formed in one body through thin hinge parts 12 in a rectangular frame part 11 and made of, for example, a single crystalline silicon semiconductor. Stopper boards 14, 15 are fixed with adhesive 16, 17 to both sides of the frame part 11 to prevent the mass part 13 from replacing excessively and destroying. Then, when acceleration is applied to the frame part 11 in a direction perpendicular to a plate of the acceleration sensor, the hinge parts 12 are bent to cause the mass part 13 to replace in the direction opposite to the acceleration so that the applied acceleration is measured by detecting the replacement.

[0003] Such acceleration sensors are made, for example, by photo-etching a series of plural chips 19 composed of frame parts 11, hinge parts 12 and mass parts 13 on a single crystalline silicon semiconductor wafer 18, as shown in FIG. 3A. As shown in FIG. 3B, adhesive 22 is screen-printed at portions corresponding to peripheries of each of the chips 19 on a semiconductor wafer 21 for stoppers. The semiconductor wafer 18 is put between

the two semiconductor wafers 21, 23 for stoppers to position each of the adhesives 22, 24 at the peripheries of the chips 19, as shown in FIG. 4A, and fixed under pressure to form as shown in FIG. 4B. After the fixing, it is cut to separate chips as shown by dotted lines and to make plural acceleration sensors shown in FIG. 2.

[0004]

[Problems to Be Solved by Invention] When the semiconductor wafer 18 for chips and the semiconductor wafers 21, 23 for stoppers are laid on each other and fixed with adhesive under pressure, layers of the adhesives 22, 24 are liable to spread under the pressure, and the spread width of the adhesives is not uniform and has large undulation on both sides of the adhesives when the wafer 18 is watched in a vertical direction, so that it is difficult to over lay them on each other according to the spread width and forms of the adhesives 22, 24.

[0005] In view of this, if width of parts of the frame part 11 does not have enough room, the adhesive comes into the hinge parts 12 and the mass part 13, so that the hinge parts 12 and the mass part 13 will be inoperable and that it does not work as an acceleration sensor. Because of this, it is difficult to miniaturize an acceleration sensor.

[0006]

[Means for Solving the Problems] By the invention, first and second grooves are formed on an inner surface of each of first and second stopper boards to extend adjacent hinge parts and along inner peripheries of a frame.

[0007]

[Example] FIG. 1 is an explanatory drawing of an example of the invention and shows plural acceleration sensors before separation when they are made simultaneously. A is a cross-sectional view corresponding to FIG. 4B and uses like numerals for like parts. Also, FIG. 1 uses the same numerals as each part in FIG. 2 showing a separated and finished acceleration sensor. In the invention, grooves 31, 32 are formed on stopper boards 14, 15, extending adjacent and outside hinge parts 11 and along inner peripheries of a frame part 11. For example, as shown in FIG. 1B, adhesive 21 is printed on an adhesion surface of a semiconductor wafer 21 for stoppers, which is fixed to a semiconductor wafer 18 for chips, in a rectangular pattern corresponding to a periphery of each of the chips.

The grooves 31 are formed to contact to inner and outer peripheries of patterns of the adhesive 21 and to extend along the peripheries.

[0008] The grooves 32 are formed in the same manner as the grooves 31. Accordingly, when the semiconductor wafer 18 for chips and the semiconductor wafer 21, 23 for stoppers are laid on each other and fixed with adhesive under pressure, the adhesives 22, 23 spread under pressure enter the grooves 31, 32 but do not spread outside the grooves 31, 32 nor reach the hinge parts 12 and the mass parts 13. The distance D between neighboring grooves 31, 32 is set to be an objective width of the adhesives 16, 17 and the width of the adhesives 16, 17 can be set to the objective value. The depth of the grooves 31, 32 is so that they can accept an excess of the adhesive but as small as possible.

[0009]

[Advantage of Invention] As explained above, by the invention, an acceleration sensor working well can be obtained since grooves are formed adjacent the inner peripheries of the frame parts and adhesive does not reach the hinge parts and the mass parts, and the acceleration sensor can be miniaturized because an excessive adhesive is absorbed into the grooves and because the dimensions of the frame parts do not need an excess room.

[Brief Description of Drawing]

[FIG. 1] A is a cross-sectional view showing the chained acceleration sensors of example of the invention, B is a plan view showing the semiconductor wafer 21 for stoppers before adhesion and C is an enlarged view showing portions circled by a dotted line in A.

[FIG. 2] A is a plan view showing a conventional acceleration sensor without a stopper board and B is a cross-sectional view taken along the line A-A' of it.

[FIG. 3] A is a plan view showing a semiconductor wafer for chips on which hinge parts 12, mass parts 13 and so on are formed to manufacture plural acceleration sensors simultaneously and B is a plan view of a semiconductor wafer for stoppers corresponding to the stopper boards 14.

[FIG. 4] A is a cross-sectional view showing a semiconductor wafer 18 for chips positioned between semiconductor wafers 21, 23 for stoppers, B is a cross-sectional view of its ideal state after fixed under pressure and C is a cross-sectional view of its normal state after fixed under pressure.

[FIG. 1]

FIG. 1

| | | |
|---|---|---|
| A | (16) 22 | adhesive |
| | 14 | stopper board |
| | 12 | hinge parts |
| | 32 | groove |
| | 24 (17) | adhesive |
| | 11 | frame part |
| | 13 | mass part |
| | 15 | stopper board |
| B | 31 | grooves |
| | 22 | adhesive |
| C | 24 | adhesive |
| | 32 | groove |

[FIG. 2]

FIG. 2

| | | |
|---|---|---|
| A | 11 | frame part |
| | 12 | hinge part |
| | 13 | mass part |
| B | 12 | hinge part |
| | 14 | stopper board |
| | 16 | adhesive |
| | 11 | frame part |
| | 17 | adhesive |
| | 15 | stopper board |
| | 13 | mass part |

[FIG. 3]

FIG. 3

| | | |
|---|---|---|
| A | 19 | chips |
| B | 21 | semiconductor wafer for stoppers |

22 adhesive

[FIG. 4]

FIG. 4

A

B

C